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CERTIFICATION OF TRANSLATION

This certifies that the attached document was translated by Dr. Burrichter, European Patent Attorney to COHAUSZ & FLORACK, of Bleichstrasse 14, 40211 Düsseldorf/Germany, from German into English, and that it is, to the best of my knowledge and belief, an accurate and faithful rendition of the original text of International patent application WO 2005/064255 A1.

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(Dr. Arwed Burrichter)

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Refractory Body

The invention relates to a heat protection body for a furnace inner wall, with a front side, a rear side, and the peripheral sides connecting the front side and the rear side, as well as a protection system for a boiler tube wall with at least one retaining element projecting from the boiler tube wall and at least one heat protection body held by the retaining element.

Usually the inner walls of furnaces are clad with heat protection bodies of this kind to protect them from overheating such as would damage the material. In this situation, the mostly plate-shaped heat protection bodies have on their rear side, facing the furnace wall, a cut-out or aperture in the form of a hole or groove, into which engages a retaining element secured to the furnace wall, as a result of which the heat protection body is anchored to the furnace wall. To create a full-surface heat-conducting connection between the heat protection bodies and the furnace wall, these bodies are coated on the rear side with a heat-conductive filler material, such as mortar, wherein the aperture into which the retaining element engages is completely filled with mortar. As an alternative, this cavity can also be cast with concrete, for example.

In US 5,243,801 a tile-shaped heat protection body is described for the refractory cladding of a furnace, in particular for the cladding of a heat exchanger. For the purpose of accommodating a T-shaped retaining element, the body has in its rear side, facing the boiler tube

wall, an open groove, wherein the groove comprises two cut-outs in its longitudinal direction, ie a cut-out with rectangular cross-section on the peripheral side and a second cut-out with T-shaped cross-section adjacent to this longitudinally. An advantage of this arrangement is that it allows for simple insertion of the retaining element. In this situation, in the first instance the heat protection tile is placed onto the T-shaped retaining element so that this engages into the groove cut-out with rectangular cross-section on the peripheral side. The heat protection tile is then pushed relative to the retaining element as far as the stop defined by the inner groove end, wherein the retaining element engages in the T-shaped groove cut-out and fixes the tile securely to the boiler tube wall. Before installation, the tile is coated on its rear side with a heat-conductive mortar. In this situation, the volume enclosed by the groove is additionally completely filled with mortar to produce a heat bridge with the largest possible surface.

In this situation, the problem regularly arises that the mortar located in the groove can easily fall out of the groove cut-out with rectangular cross-section, open upwards, as a result of which air inclusions form between the heat protection tile and the boiler tube wall, which lead to an irregular dispersion of heat and therefore to overheating of the ceramic material of the tiles at individual points.

It is therefore an object of the present invention to provide a heat protection body which allows for easy installation to a furnace inner wall which is to be clad, and which is designed in such a way that unintentional

emergence of the filler material is effectively prevented.

This object is resolved by a heat protection body for a protection system for a furnace inner wall with a front side, a rear side, and the peripheral sides connecting the front side and the rear side,

- wherein the heat protection body has in its rear side at least one groove to accommodate a retaining element,
- wherein the groove has a first face-side end, open to one peripheral side, and a second face-side end located in the interior of the rear side, and
- wherein the groove has a cross-section which broadens from the rear side in the direction of the front side.

The heat protection body according to the invention has a groove with a cross-section which broadens in the direction of the front side. This groove serves to accommodate a retaining element connecting to the boiler tube wall, which in turn is to be shaped in such a way that it broadens in the direction of its projecting end to correspond to the shape of the groove cross-section, so that a connection free of play is provided between the heat protection body and the boiler tube wall. The groove has a first face-side end open to a peripheral side and a second face-side end located in the interior of the rear side. In the meaning of the invention it is to be understood by this that the second end of the groove is arranged at any desired distance from one of the peripheral sides of the heat protection body, so that it can form a stop for the retaining element which is to be inserted.

For the purpose of the installation of the heat protection body, by contrast with the prior art described heretofore, this is pushed over the face side of the groove, open to one of the peripheral sides, onto the free end of the retaining element as far as the stop defined by the other end of the groove, wherein the end of the retaining element connected to the wall is guided along the opening surface of the groove.

The particular advantage of the shape of the groove cross-section selected according to the invention lies in the fact that the surface of the groove open to the rear side of the heat protection body can be designed as very narrow, practically slit-shaped, so that the heat-conductive filler material located in the groove, preferably mortar or concrete, has practically no possibility at the rear side of falling out of the groove or flowing to it. The retaining element in turn is protected completely by the heat protection body from the flue gas of the furnace.

Preferably, the heat protection body is designed as a plate-shape. This shape allows for a defined large-surface front side and rear side, which are connected to one another by peripheral sides designed to be narrow. This guarantees an effective heat protection of the furnace wall and long service life of the heat protection body. With the appropriate shaping of the front side and rear side respectively, for example with heat protection bodies designed as rectangular or square in shape, extended furnace walls can be clad over large areas by a plurality of heat protection bodies.

The cross-section of the groove, provided in the rear side of the heat protection body and broadening in the direction of the front side, can be designed in various ways. Thus, for example, on the one hand it is possible for the groove cross-section to broaden step by step from the rear side in the direction of the front side. In this situation, the groove could, for example, have a T-shaped cross-section. It is likewise possible for the groove cross-section to broaden constantly from the rear side in the direction of the front side, wherein in this case a trapezoidal or dove-tailed cross-section is preferred.

According to a further advantageous embodiment of the invention, provision is made for the cross-section of the groove to taper in the longitudinal direction of the groove from the peripheral side inwards. This has technical production advantages in particular, since in this case a core which is introduced into the source material during the production of the heat protection body can be more easily removed again from the finished manufactured heat protection body. This shaping also facilitates the introduction of the retaining element into the groove, since this still has relatively large play at the open face side of the groove and in the course of the heat protection body being pushed onto the retaining element it gradually adopts its defined position in the groove.

In order to guarantee a high level of heat resistance and long service life of the heat protection body, it is expedient for this to be manufactured from a ceramic material, preferably from silicon carbide.

According to a further advantageous embodiment of the invention, at least one peripheral side has a step

running essentially parallel to the front side. When the heat protection body is installed on the furnace wall, this accordingly allows for abutting peripheral sides of adjacent heat protection bodies to engage in one another by way of their stepped sides, to which end these peripheral sides must be stepped appropriately offset to one another. As a result, on the one hand a precise placement of the heat protection bodies at the furnace wall is facilitated, while, in addition, this effectively prevents a direct penetration of flue gases from the furnace to the screened furnace wall.

If the heat protection body serves not only as a heat resistant cladding of a furnace inner wall, but additionally as the means of heat dissipation into a heat exchanger, such as, for example, in the case of a boiler tube wall, the best possible heat transfer from the heat protection body into the rear side wall is to be striven for. To this end, the heat protection body should be located as tight against the wall as possible, or any gap which might exist between the heat protection body and the wall should be designed to be as narrow as possible. This can be achieved by the rear side being shaped to the outer contour of the furnace wall.

It is a further object of the present invention to provide a protection system for a boiler tube wall which is easy to install and allows for an effective protection of the boiler tube wall with, at the same time, the greatest possible heat dissipation into the boiler tube wall.

This object is resolved according to the invention with a protection system for a boiler tube wall with at least one retaining element projecting from the boiler tube

wall and at least one heat protection body held by the retaining element according to one of Claims 1 to 8, wherein the retaining element has a free end corresponding to the cross-section of the groove.

As already mentioned earlier, an effective heat transfer from the interior of the furnace into the boiler tube wall is possible in particular if the heat protection body is located at the boiler tube wall as far as possible free of gaps and play. In this context, the decisive factor is the matching of the geometries of the groove cross-section and of the retaining element. According to the invention, the retaining element has a free end corresponding to the cross-section of the groove. This means specifically, that in the case of a groove designed in a T-shape, for example, the retaining element is designed accordingly as a T-anchor.

The retaining element is preferably located at tube fins which are arranged between the tubes of the boiler tube wall. In particular, the longitudinal axis of the retaining element is arranged perpendicular to the surface of the boiler tube wall, in particular the tube fins.

The advantages of the invention are achieved with protection systems which have only one heat protection body. As a rule, however, a boiler tube wall is protected by a wall of heat protection bodies arranged above and next to one another. In this case, the advantages according to the invention are achieved in particular if all the heat protection bodies of the protection system are secured to the boiler tube wall in accordance with the principle according to the invention. The heat protection bodies can be placed directly, without any

substantial gap, on and next to one another, but can also be placed with a gap. The gap between the heat protection bodies and the gap between each heat protection body and the boiler tube wall are in this situation for logical reasons filled with a filling material, in particular mortar and joint expansion material, in order to optimise the heat transfer and improve the protection against flue gas.

The invention is explained in greater detail hereinafter on the basis of drawings representing an embodiment. The drawings show:

Fig. 1: A protection system for a boiler tube wall, in which the boiler tube wall is partially clad with heat protection bodies in a perspective view,

Fig. 2: An enlarged extract from Fig. 1 corresponding to the line II from Fig.1,

Fig. 3: A heat protection body of the protection system from Fig. 1 in a perspective view of the rear side of the body,

Fig. 4: The rear side of the heat protection body of the protection system from Fig. 1 in a plan view,

Fig. 5: A side sectional view of the heat protection body of the protection system from Fig. 1 along the line V-V from Fig. 3,

Fig. 6: A side section view, rotated through 90º of the heat protection body of the protection system from Fig. 1 along the line IV-IV from Fig. 3.

The protection system from Fig. 1 comprises a boiler tube wall 1, which is clad on the furnace side with heat protection bodies 5, wherein the boiler tube wall 1 in the present case, for ease of overview, is clad only partially with heat protection bodies 5. The boiler tube wall 1 itself consists of parallel tubes 2 and the tube fins 3, connecting the tubes pair by pair in web fashion. The heat protection bodies 5 are in each case secured to the boiler tube wall 1 by means of the T-shaped retaining elements 4 welded to the tube fins 3, as is explained in detail hereinafter.

Each heat protection body 5 is designed as a square plate and comprises a front side 7, a rear side 8 located opposite the front side 7, and the peripheral sides 11, 12, 13, 14, connecting the front side 7 to the rear side 8 and standing perpendicular to them. Other geometries are likewise possible, such as, for example, regular hexagons, by which the wall can be clad in honeycomb fashion. The heat protection body 5 consists at least on its front side 7, facing the flue gases of the furnace, of a heat-resistant ceramic material, preferably silicon carbide. On its rear side 8, the heat protection body 5 has a groove 6 for accommodating the retaining element 4, wherein the groove 6 comprises a first face-side end 6a, open to the peripheral side 14, and a second face-side end 6b located in the interior of the rear side 8. The groove 6 further has a cross-section which broadens in the direction of the front side 7. In this present case, it is designed as a T-shape, so that an optimum bedding of the T-shaped retaining element 4 in the groove 6 is

guaranteed. The groove can equally well have a cross-section which broadens constantly in the direction of the front side, for example in the shape of a trapezoid, wherein in this case the retaining element has a corresponding shape.

The rear side 8 of the heat protection body 5 is, as represented in Fig. 3, adapted to the shape of the boiler tube wall 1. It therefore has semi-cylindrical areas 9 for the tubes 2, as well as a flat surface 10 located between, which in the secured state of the heat protection body 5 is located opposite the tube fins 3 arranged between the tubes 2.

For the purpose of the fitting of the heat protection body 5 to the boiler tube wall 1, the T-shaped retaining element 4 is introduced into the groove 6 via its open end 6a, and the heat protection body 5 is then pushed relative to the fixed-location retaining element 4 until it comes into contact with the face-side end 6b of the groove 6 located in the interior of the rear side 7. The introduction of the retaining element 4 into the groove 6 is also facilitated by the fact that the groove cross-section tapers in the longitudinal direction of the groove 6 from the open end 6a in the direction of the inner end 6b. In the present case this is realised in that the inner faces 6c of the groove delimiting the longitudinal sides of the transverse braces 4a (see Fig. 2) of the T-shaped retaining element 4 run obliquely to one another (see Fig. 5). On being introduced into the groove 6, the retaining element 4, therefore, still has a relatively large amount of play at the open face side 6a of the groove 6, wherein, when the heat protection body 5 is being pushed on, it gradually adopts a defined position in the groove 6 transverse to its course.

To optimise the heat transfer into the boiler tube wall and to improve the protection of the boiler tube wall 1 against flue gases, the narrow gaps between the individual heat protection bodies 5 and the boiler rear wall 1, and the gap between the individual heat protection bodies 5, are filled with a filler material, in particular with mortar, concrete, and/or expansion joint material. Likewise, the volume enclosed by the groove 6 in each heat protection body 5 is filled completely with the filler material, wherein the mortar layer is not represented in Figs 1 and 2 for reasons of easier overview. A particular advantage of the heat protection bodies 5 according to the invention in this case lies in the fact that, because of the very small, practically slit-shaped opening surface of the groove 6, the mortar in the groove 6 has practically no possibility of falling out at the rear side, wherein air inclusions would be formed, which in turn would lead to local overheating of the material. Due to the end 6a of the groove 6, open on the peripheral side, the filler material also can only emerge with difficulty.